The Family Gnathiidae (Crustacea: Isopoda). A New Victorian Species

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Gnathiids are related to slaters, marine pill bugs, fish lice, sea centipedes and various other isopod crustaceans that are more or less familiar to naturalists who spend some time near the sea. However, they are small and cryptic, and consequently little known to people who have not studied the isopods in some detail.

Some Features of Gnathiid Structure and Biology

Members of the various sub-groups of the Isopoda are all sufficiently different from one another to be readily distinguished. Gnathiids, however, are more different (which is easier to do than being "more equal"), and it was proposed by Monod (1922) that they should be placed all by themselves in a separate group of Isopoda called Decempedes. The reason for this proposal is that gnathiids have only five pairs of legs, whereas normal adults of the other isopod groups have seven pairs of legs and are grouped together as the Quatuordecempedes. It has recently been proposed (Hurley & Jansen 1977) that these two major subdivisions should be called suborders and the subdivisions of the Quatuordecempedes should be called infraorders, which I think is likely to be accepted by taxonomists.

What has happened to the gnathiids' other two pairs of legs? Their absence (as legs) exemplifies two phenomena well known to zoologists. The front pair has been converted into gnathopods (supplementary mouthparts) in the juveniles, and in the adults they have become structures called pylopods, which are often plate-like and probably are used as ventillating organs. The segment from which the pylopods originate (the second thoracic segment of the embryo) is always at least partly fused to the head. The first segment is fused with the head in all isopods. Incorporation of thoracic segments and their appendages into the head of an animal is called cephalization. (The decapod crustaceans provide an even better example, with their three pairs of maxillipedes which are used as feeding appendages.)

The complete absence of what would be the sixth pair of legs (seventh in other isopods) can be regarded as an example of paedomorphosis, a phenomenon in which juvenile characters—absent at maturity in most other species of the group—are retained in the adult. In most species of the Quatuordecempedes the young have only six pairs of legs when they emerge from the brood pouch, and the seventh pair usually appears at the first moult, which occurs soon afterwards. Not only do the hind legs not develop in the gnathiids, but also the last thoracic segment is much reduced, and looks as though it is a part of the abdomen ("tail").

Species of this family illustrate also the phenomenon of polymorphism, the males and females and juveniles of each species being superficially quite different. This led to difficulties in the early classification of the group around 150 years ago, which were not resolved until 1880. The polymorphism is well shown by the new species described below.

Many gnathiid species live, as adults, in tubes made by their own burrowing or by other animals, so the hind end of

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the male may be left protected by the tube while the front end emerges to deal with potential invaders or predators, to feed, or for any other purpose. It is possibly for this reason that they have developed a heavily-chitinized or indurated set of sclerites surrounding the head and anterior segments, a more-lightly sclerotized posterior region (pleon), and a very thin integument over the middle region (posterior thorax).

A similar adaptation is seen in the aquatic larval stages of the insect order Trichoptera—caddis flies—which live in tubes under similar conditions. This may be regarded as an example of convergent evolution, which is the tendency for unrelated animals, living in a similar way, to develop similar adaptations to that way of life.

Female gnathiids (at least in the species described below) are fairly uniformly chitinized when mature, but in juveniles—as in males—only the coxal plates (representing the proximal leg-joints) are thickened in the posterior thoracic region. However, the juveniles are not tubicolous. My field-naturalist readers will no doubt enjoy thinking of ways to account for these different adaptations within the one species.

Life History

Juveniles in this family are micro-predators on the surface of fishes, or in their gill chambers or pharynx. Their mouthparts are adapted for piercing and sucking, by which means they feed until ready to moult. Apparently they then leave their host, digest the food with which they are distended, moult, and find a new host on which to start their new instar (growth stage).

The full life history of most species of gnathiid is not yet known, but in one European species, *Gnathia maxillaris*, there are three instars, after which the juvenile metamorphoses into either a male or female (Mouchet 1928). In another European species, *Paragnathia formica*, each male commonly has a harem of ten or more females (Pierre & Théodoridès 1948) but the species described here has not been found *in situ* with more than two females: one older and gravid, or post-partum, and the other recently metamorphosed or even still in the late juvenile state.

Australian Gnathiidae and the New Species

This is only the eighth Australian species of the family to be described (others await description). The previously-described species are, in chronological order, *Elaphognathia ferox* (Haswell), 1884, *Gnathia latidens* (Beddard), 1886, *G. mulieraria* Hale, 1924, *G. pustulosa* Hale, 1924, *G. calamitosa* Monod, 1926, *G. calmani* Monod, 1926, and *G. halei* Cals, 1973. The paper of Cals includes a key to all of these species. A monograph by Monod (1926) describes the morphology, biology and systematics of the Gnathiidae. Monod's first contribution to the crustacean literature appeared in 1922; his most recent contributions were six papers in 1976.

The new Victorian species was first noticed by Mr. A. G. Willis, of the Department of Zoology, University of Melbourne, who found a single juvenile at Shoreham in 1954. the specific epithet records Mr. Willis's discovery of the species. Three years later that specimen became the basis of my final-year project as a student in that department, a project which led ultimately to a broader interest in marine isopods.

Only juveniles were found in the course of that project—almost fifty of them—and adults were not discovered until 1960, at Airey's Inlet. They were in the tubes of what proved to be a new species of polychaete worm—*Rhamphobrachium sp.* tubes which penetrated into the dune limestone of

the reef and were surrounded at the surface by an encrusting calcareous alga. Specimens have since been found in and among the tubes of *Galeolaria caespitosa*.

As the adults were first found at Airey's Inlet I have designated it as the type locality and used a series of specimens collected there as a basis for the description.

Taxonomy

Genus *Gnathia* Leach, 1813

Isopoda with the characteristics of the Decempedes. Males are distinguished from other genera of the suborder by having the third joint of the pylopod minute or absent, and the basal joint lamelliform, with the outer border much shorter than the inner; mandibles taper broadly to an edge medially, to a single point distally.

Gnathia agwillisi, new species

Diagnosis

Adult male

Gnathia of Monod's section 1 (Transversae); tuberculate to conically-spinose dorsally and laterally on the head, and on the tergites of segments I-IV (I and II fused to the head); tergite V tuberculate-spinosa only on the antero-lateral regions of the two indurated parts, and with an anterior constriction (caesura). Third pereiopods (on segment V) have conspicuous, strongly-calcified tubercles on the basis, and lesser ones on succeeding joints. The pleon is as wide as the casura, and about one-third wider than the length of its first five segments. Telsonic segment and telson together longer than the rest of the pleon; telson large, an ovoid plate, subtruncate behind, forming with the uropods a tailfan about as wide as the head. All setae of the tailfan are simple.

Mandibles of the simplest typical form. Third article of pylopod obscure, indicated only by a notch on the median edge. Preocular lobes tuberculate-spinose and conspicuously calcified. Tergites of the fourth and fifth pereional somites with a median division. Penes barely discernible; appendix masculina not developed. Legs typically held as shown in Fig. 1d. Median length of holotype, to tip of mandibles: 5 mm.

Mature female

Two large pairs of oostegites cover the ventral surface of the pereion; a small pair is associated with the pylopods. Pereional tergites are distinct on all free segments, those of VI and VII each with an obscure median anterior projection, which matches a posterior notch in the preceding tergite, and a pair of long, thin apodemes extending forward from the anterior edge. Pleon about as wide as the length of its first five segments. Telson a large, subquadrate plate, forming with the uropods a tailfan about as wide as the head. All setae of the tailfan are simple. Median length of paratype: 7.5 mm.

Praniza larva

From the second instar onwards there is a dense pelage of long, fine hairs along the leading edge of the antennae, longest on the peduncle. The pleon is very strongly developed and about as wide as the first free segment of the pereion. Tailfan, including setae, is more than twice as wide as pleon; anterior edge of uropods is recurved dorsally. The setae of the telson are simple, and so are the outer setae of

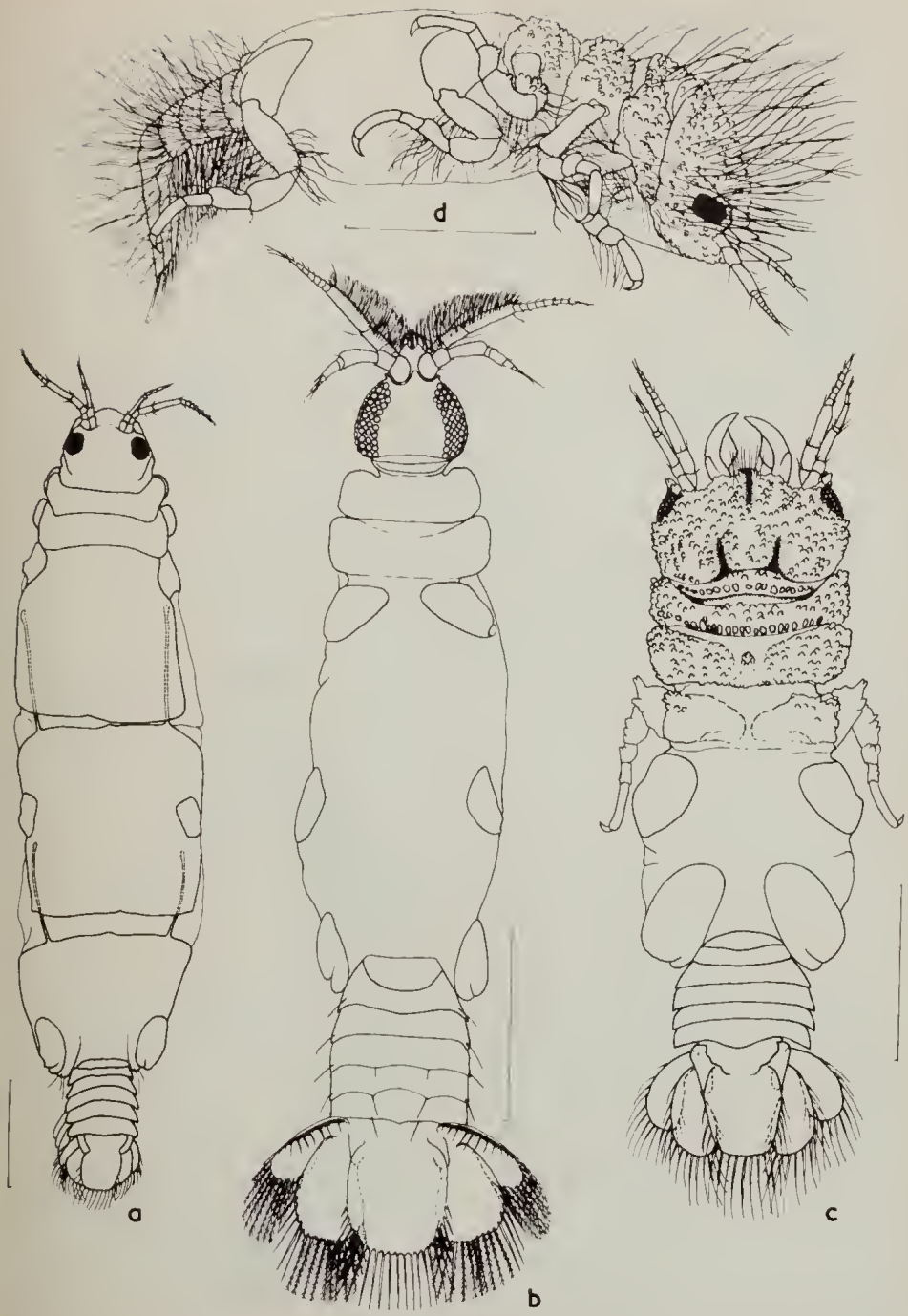

Fig. 1. *Gnathia agwillisi* n. sp. a: post-partum female; b: last-instar juvenile (praniza); c: adult male, with "pelage" omitted; d: adult male, showing characteristic position of the legs, and most of the long hairs. Each scale line represents 1 mm.

Fig. 2. *Gnathia agwillisi*, larval mouthparts from the right side. a: gnathopod, b: mandible, c: maxillule, d: maxilla, e: maxillipede. Antennule and antenna, dorsal view—f: female; g: male; h: late larva.

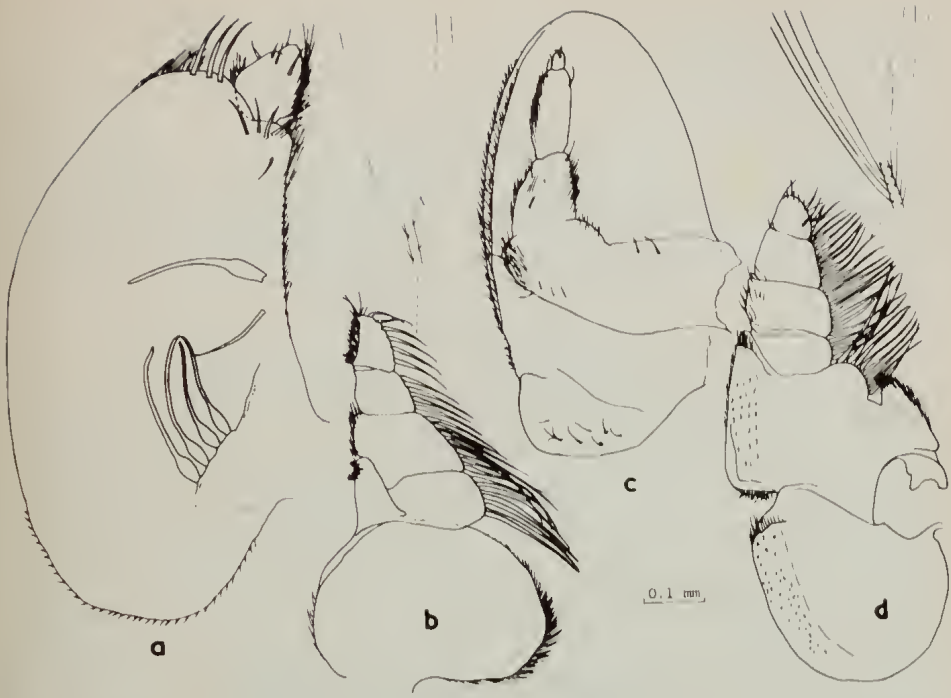

Fig. 3. *Gnathia agwillisi*. a: left pylopod of male; b: left maxillipede of male; c: left pylopod and associated oostegite of female; d: left maxillipede of female.

the uropodal endopods; the remainder are pectinate. Median length of paratype larva: 4.8 mm.

Type Material

Types are lodged in the National Museum of Victoria. Holotype male NMV No. J184 and six paratypes (2 males, 2 females and 2 larvae) plus 3 paratype slides of appendages. NMV No. J185, collected by W. Seed, January, 1960.

Type Locality

Airey's Inlet, Victoria.

Distribution

Victorian coast, from Westernport to Cape Otway. Adults found in tubes of *Rhamphobrachium* and *Galeolaria*, and may occur interstitially in *Galeolaria* colonies. Larvae are found in almost any material from littoral or infra-littoral fringe; larval host(s) unknown.

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REFERENCES
Beddard, F. E., 1886.—Report on the Isopoda collected by H.M.S. Challenger during the years 1873-76. Part II. *Challenger Reports, Zool.* **17** (48), 1-178, pl. 1-25.
Cals, P., 1973.—Sur une espèce nouvelle de *Gnathia* d'Australie. *Gnathia haleyi* (Crustacea, Isopodes). *Bull. Mus. Hist. nat., Paris*, sér. 3, 115, *Zool.* **89**, 295-305.
Hale, H. M., 1924.—Notes on Australian Crustacea No. II. *Trans. R. Soc. S. Aust.* **48**, 2-6, pl. 1-2.
Haswell, W. A., 1884.—A revision of the Australian Isopoda. *Proc. Linn. Soc. N. S. Wales* **9**, 1001-15, pl. 50-53.
Hurley, D. E. & Jansen, K. P., 1977.—The marine fauna of New Zealand: Family Sphaeromatidae (Crustacea Isopoda: Flabellifera). *Mem. N.Z. oceanogr. Inst.* **63**, 1-84, pl. 1-11.
Monod, Th., 1926.—Les Gnathiidae. Essai monographique (Morphologie, Biologie, Systématique). *Mem. Soc. Sci. nat. phys. Maroc* **13**, 1-668, 1 pl.
Mouchet, S., 1928.—Note sur le cycle évolutif des Gnathiidae. *Bull. Soc. zool. Fr.* **53**, 392-400.
Pierre, F. & Théodoridès, J., 1947.—La cohabitation de *Dichirotrichus pubescens*, de *Bledius spectabilis* et *Paragnathia formica* dans le Schorre, à l'estuaire de la Penzé (Finistère). *Bull. Soc. zool. Fr.* **71**, 151-56.

Notes on Gold Coast Butterflies

The year 1978 commenced with a scarcity of usually common species no doubt due to the prolonged dry spell over the preceding months. The usual "Wet Season" was poor and brief, some 25 inches of rain being recorded in March followed again by dry conditions which have prevailed with exception of some intermittent light showers up to the present time, December, 1978.

Common species such as the blue Triangle (*Graphium sarpedon choredon* (Feld.)) and pale green Triangle (*Graphium eurypylus lycaon* (Westw.)) have been very scarce. During April and May the large Orchard Swallow Tail (*Papilio aegeus aegeus* (Don.)) was very common, much more so than usual. Other normally common species were not in evidence.

In late August very large numbers of the Pea Blue *Lampides boeticus* (L.) occurred for about 2 weeks. These were followed by almost equal numbers of the small Common Grass Blue (*Zizeeria otis labradus* (Godt.)) and such numbers have persisted up till the time of writing (Dec. 1978). The months of September-November produced great numbers of the Meadow Argus (*Precis villida calybe* (Godt.)), a species usually plentiful during those months but much more so this season. The Blue Spotted Painted Lady (*Vanessa cardui kershawi* (McCoy)) never seen abundantly on the Gold Coast was, and still is, present in quantity. Immediately following these was a great flight of the Common Caper White *Anaphaeis java teutonia* (Fab.)), the largest numbers of this migratory butterfly that I have ever observed on the coast. Every year during November normal flights do occur, but last only a few days (not a month as is the case of this year's flight). The author captured 2 pairs just for record and to his amazement one of these four (4) specimens was a "Gynandromorph" i.e. a specimen with male wing pattern on the right side of the wings and female on the left side! I believe that the chances of obtaining such rare specimens is about one in two million!

As is usual in early November the Chequered Swallow Tail (*Papilio demoleus sthenelus* (Macl.)) was completely absent, not a single specimen being seen. Another interesting butterfly, the Big Greasy (*Cressida cressida cressida* (Fab.)) has been, and is more plentiful than usual. The Blue Tiger (*Danaus hamata hamata* (Macl.)) has been and is much commoner than usual for this time of year. The appearance too of the Red Eyed Skipper (*Chaetocneme beata* (Hew.)) which flies at dusk and is not often seen was noted flying at Orange blossoms, at times two specimens being seen at one time.

Common pierid butterflies such as the Lemon Migrant (*Catopsilia pomona pomona* (Fab.)); the Common Albatross (*Appias paulina ega* (Boisd.)), and the ever abundant Common Grass Yellow (*Eurema hecabe phoebus* (Butl.)) have all been really scarce this season. During September-October many examples of the beautiful Richmond Birdwing (*Ornithoptera priamus richmondius* (Gray)) were noted in the garden at flowers of Bougainvillea, Buddleyia, etc., at times 6 or 7 specimens being seen at once. This fine butterfly is normally seen singly or rarely in pairs.

Many of the usually common Skippers belonging to the genera *Toxidia*, *Oeybadistes*, *Arrhenes*, and others normally to be seen everywhere have all been scarce; the only exception perhaps being the large and beautiful Symmomus Skipper (*Trapezites symmomus symmomus* (Hubn.)) which has been quite common practically throughout the year, especially so during August-October.

Should we get good rains during the coming months it will be interesting to see if we get a return to the normal occurrence of